[I~24] [초청]

CHARACTERIZATION OF TIN OXIDE FILMS PREPARED BY ION BEAM ASSISTED DEPOSITION (IBAD)

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Undoped tin oxide films were grown on Si substrates by a reactive ion-assisted deposition technique in which oxygen ions were irradiated on depositing Sn particles. In order to investigate the oxidation from SnO to SnO_2, the effects of initial oxygen contents and heat treatment on the final crystalline structure of tin oxide films were thoroughly examined. Oxygen to Sn metal ratio (N_O/N_{Sn}) of as-deposited films were controlled from 1.1 to 1.9 by varying the relative arrival ratio (Γ) of oxygen ion to Sn particle from 0.025 to 0.1. Heat treatment was carried out in two different ways; one was post vacuum-annealing at 400 ~ 600°C and the other was *in-situ* annealing 400 ~ 500°C. Crystalline structure of as-deposited tin oxide films at room temperature was amorphous. After post-annealing at 400 °C, only SnO phase was found below N_O/N_{Sn}=1.6 in x-ray diffraction and crystalline structure of the films comprising higher oxygen contents still appeared to be amorphous. Even though the films still showed SnO phase until Γ50 after 500°C post-annealing, however, mixed structures of SnO, SnO_2, and intermediate Sn_2O_3/Sn_3O_4 were observed for the films Γ75 and Γ100 with higher oxygen contents. At 600°C annealing, perfect SnO_2 phase was attained for the films having N_O/N_{Sn}=1.9. On the other hand, pure polycrystalline SnO_2 films could be obtained by *in-situ* annealing at low temperature. The values of N_O/N_{Sn} and the chemical shifts with the variation of oxidation were carefully determined by the comparison of Sn *MNN* and O *KLL* Auger transitions. In particular, the AES $M_5N_{4,5}N_{4,5}$ Auger transition peak intensity was reduced as oxidation state increased. Surface microstructure of deposited films was also analyzed using a scanning electron microscopy (SEM) and an atomic force microscope (AFM) in terms of average depositing ion energy.